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## Foraging behaviour study of honey bees on coriander (*Coriandrum sativum*)

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### Abstract

The present investigation was carried out at Pt. K.L.S. College of Horticulture and Research Station, Rajandgaon during *rabi* 2019-20. Coriander is a dual purpose crop grown for green leaf as well eatable purposes and seed as spice purpose but in Chhattisgarh mainly cultivated for spice. A large population of insects visits from initiation of flowering to harvest for foraging in seed spices coriander. The honey bee *A. dorsata* and *Apis florea* visit frequently and periodically for the collection of nectar and pollen grains. Among all pollinators, *Apis florea* was most dominating species (47.41%) followed by *A. dorsata* (21.34%), *A. mellifera* (8.65%), *Eristalis sp.* (6.35%), *Episyrphus balteatus* (5.32%), *Episyrphus sp.* (4.26%), *Musca sp.* (4.22%) and others species (2.45%). For the foraging activity *Apis florea* was also found dominant bee species followed by *Apis dorsata*. *Apis florea* population was recorded maximum at 12.00 PM noon (3.57 bees/10 min/m<sup>2</sup>), whereas *Apis dorsata* population was recorded maximum at 12.00PM noon (3.57 bees/10 min/m<sup>2</sup>).

**Keywords:** Insect pollinators, *Apis florea*, *Apis dorsata*, foraging activity

### Introduction

Coriander (*Coriandrum sativum* Linn.) is an annual herb belonging to the family Umbelliferae, grown widely in India, mainly for its leaves and seeds which have fragrant odor and pleasant aromatic taste which is a key ingredient in numerous dishes worldwide. The odor and taste are due to the presence of an essential oil which ranges from 0.1 to 1.0 per cent in dry seeds (Mane, 2003 and Meena *et al.*, 2015) <sup>[5, 6]</sup>. Flowers are small, zygomorphic and inflorescence compound umbel type. Fruits are schizocarp, round to globular, 2 to 3.5 mm in size, yellowish brown at maturity, green when young ribbed composed of two concavo-convex mizocarps with inner face of carpel having two vittae (Shanmugavelu *et al.*, 2002) <sup>[10]</sup>.

Coriander is a highly cross pollinated nature of crop, allowed a large population of insect pollinators during flowering for their pollination. The flower's fragrance of coriander is attractive due to nectar which attract the nectar feeding insect it is a good source of nectar which attract the honey bees and other insects for foraging. Foraging behaviour is one of important parameter in successful cross pollination and is variable from one pollinator species to other, even within the species. Among the various insect pollinators from different orders and families, honeybees perform the most important role in pollination of seed spices. Keeping this in view, the present experiment was conducted to identify the important Aphis species for foraging behaviour, which can be helpful for pollination in coriander.

### Materials and Methods

The experiment was undertaken at Pt. Kishori Lal Shukla College of Horticulture and Research station, Rajnandgaon during 2019-20 to study the foraging activity of honey bees during the blooming period on coriander. Variety Pant haritma of the coriander crop was raised in Randomized Block Design in plots of 3 m × 3 m (9 sq. m); before being sown the seeds were crushed into halves by gently rubbing between palms. Sowing was done by manually operated hand driven plough keeping the row to row distance of 60 cm with a seed rate of 10 kg/ha. Other recommended agronomical package of practices were followed and crop was grown organically without the use of any plant protection chemicals.

Diversity and foraging behaviour of insect visitors were recorded visually at different hours of the day *viz.* on 08.00 AM, 10.00 AM, 12.00 Noon, 02.00 PM and 4.00 PM two hours intervals and counted the numbers and averaged the population of honey bees. The observation was taken every week from the day of flower initiation from one square meter area at five spots from 1<sup>st</sup> January to 28<sup>th</sup> February 2020. The insect visitors on coriander were collected by

sweep netting using cone type hand net throughout the crop blooming period. The collected insects were killed, preserved and identified by comparing them with the reference collection maintained at Laboratory.

**Results and Discussion**

A field experiment was conducted on diversity of various insect visitors associated with coriander and foraging behaviours of honey bees at Research Farm, Pt KLS College of Horticulture and Research Station, Rajnandgaon under open field conditions. The data on average population of insect visitors (Table 1) revealed that, the coriander flowers were visited by many insect species belonging to different order and families' right from initiation of flowering to withering and even up to harvesting of crops. The pollinators fauna, which are visiting the coriander were *Apis dorsata*, *Apis florea*, *A. mellifera*, *Episyrphus balteatus*, *Eristalis tenax*, *Syrphus sp.* *Musca spp.* and other species. These finding supported by Arya *et al.* (1994) [1] recorded many species of insect pollinators, of which belonged to Hymenoptera, Diptera and Lepidoptera and Choudhary and Singh (2007) [3] also reported the insect visitors on coriander ecosystem and among them, most of the visitors belong to same category (species with orders and families).

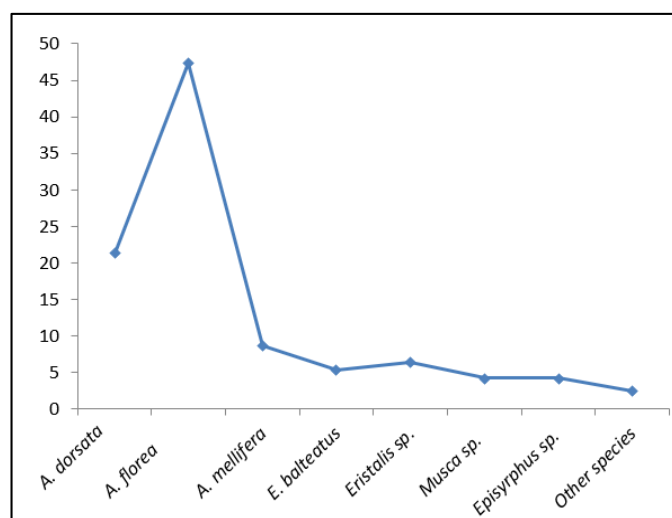
Among honey bees species, *Apis florea* and *Apis dorsata* were frequent visitors. Figure 1 showed that the *Apis florea* was recorded as most dominating species (47.41%) among all pollinators followed by *A. dorsata* (21.34%), *A. mellifera* (8.65%), *Eristalis sp.* (6.35%), *Episyrphus balteatus* (5.32%), *Episyrphus sp.* (4.26%), *Musca sp.* (4.22%) and others species (2.45%). These results were supported by Singh *et al.* (2010) [12] that Hymenopterans and Dipterans formed the major pollinators with the two species of Apis (*A. florea* and *A. dorsata*), while flies of the families Muscidae and Syrphidae dominated. Bendifallah *et al.* (2013) [2] also reported that the insect fauna of coriander includes Diptera (Syrphidae), Coleoptera, and Hymenoptera such as Chrysididae, Vespoidea and Apoidea (bees).

The daily activity of insect pollinators showed that, activity begins at the morning (its variable) and reached to the maximum between 12 PM under the study then decreased till sunset (Table 2). Similar activity has been documented in coriander and cucumber (Kumar, 2010 and Sajjanar *et al* (2004) [4, 9]. The population of *Aphis florea* was recorded higher at 45.06 bees at 12.00 hrs noon (5.01 bees/10 min/m<sup>2</sup>) followed by followed by at 10.00 AM (4.0 bees/10 min/ m<sup>2</sup>)

at the 2.00 PM and 4.00PM were also recorded lower population (3.86 bees/10 min/m<sup>2</sup>) and (3.04bees/10 min/m<sup>2</sup>), respectively. However the lowest population was recorded at 8.00 PM (2.80 bees/10 min/m<sup>2</sup>). *Apis dorsata* population was recorded maximum at 12.00PM noon (3.57 bees/10 min/m<sup>2</sup>) followed by (3.49 bees/10 min/m<sup>2</sup>) at 10.00 AM and lower population was noticed at 2.00PM and 4.00 PM (3.43 bees/10 min/m<sup>2</sup>) and (1.87 bees/10min/m<sup>2</sup>), respectively however the lowest was recorded at 8.00PM (2.47 bees/10 min/m<sup>2</sup>). Similar findings were reported by Painkra (2019) [7] who reported that the maximum foraging activity were noticed at 12.00 PM noon. Sharma and Meena 2019 [11] also recorded *Apis florea* as a dominant spp. and good forager. Patil and Pastagia (2016) [8] also noticed *Apis florea* as a predominant visitor of coriander followed by *A. dorsata*.

**Table 1:** Diversity of floral visitors visiting coriander during Rabi 2019-20.

S. No.	Insect visitors	Proportion (%) of insect visitors
1	<i>Apis dorsata</i>	21.34
2	<i>Apis florea</i>	47.41
3	<i>Apis mellifera</i>	8.65
4	<i>Episyrphus balteatus</i>	5.32
5	<i>Eristalis sp.</i>	6.35
6	<i>Musca sp.</i>	4.22
7	<i>Episyrphus sp.</i>	4.26
8	Other species	2.45



**Fig 1:** Proportion (%) of Insect visitors

**Table 2:** Foraging activity of honey bees on coriander flowers.

Date of observation	No. of bees/10 minutes/m <sup>2</sup> Coriander									
	<i>Apis dorsata</i>					<i>Apis florea</i>				
	8AM	10AM	12PM	2PM	4PM	8AM	10AM	12PM	2PM	4PM
01-01-2020	1	3.83	3.33	2	3.67	1.33	4.17	4.67	3.5	3.5
07-01-2020	2.5	3.33	3.17	3.5	3.83	2.67	3.33	4	3.33	3.33
14-01-2020	2.17	3.17	3.17	3.83	3.17	2.83	4.17	5.5	4.17	3.5
21-01-2020	2.43	3.29	3.86	4	3.71	2.43	4.57	6.14	4.00	4
28-01-2020	2.29	3.86	4.29	3.14	2.86	2.86	5	5.43	3.71	3
04-02-2020	2.86	4.14	3.86	3.86	2.57	2.86	3.86	5.29	4.29	2.86
11-02-2020	3	3	3.71	3.29	1.86	3.14	3.29	4.57	3.71	2.71
18-02-2020	3	3	3.71	3.29	1.86	3.57	3.86	5.71	4.00	2.43
25-02-2020	3	3.75	3	4	1.75	3.5	3.75	3.75	4	2
Total	22.24	31.37	32.10	30.90	25.27	25.19	35.99	45.06	34.71	27.33
Mean	2.47	3.49	3.57	3.43	2.81	2.80	4.00	5.01	3.86	3.04

## Conclusion

It is concluded species of honey bees i.e. *Apis dorsata* and *Apis florea* were recorded to visiting the coriander flower. Among them *Apis florea* was found dominant spp. and good forager. Overall the maximum foraging activity was recorded at 12.00 PM noon so it is suggested not to apply the insecticides during the visitation of honey bees. Among, four Apoidea species, *A. florea* (47.41%) was recorded as most dominant pollinator on coriander followed by *A. dorsata* (21.34%).

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